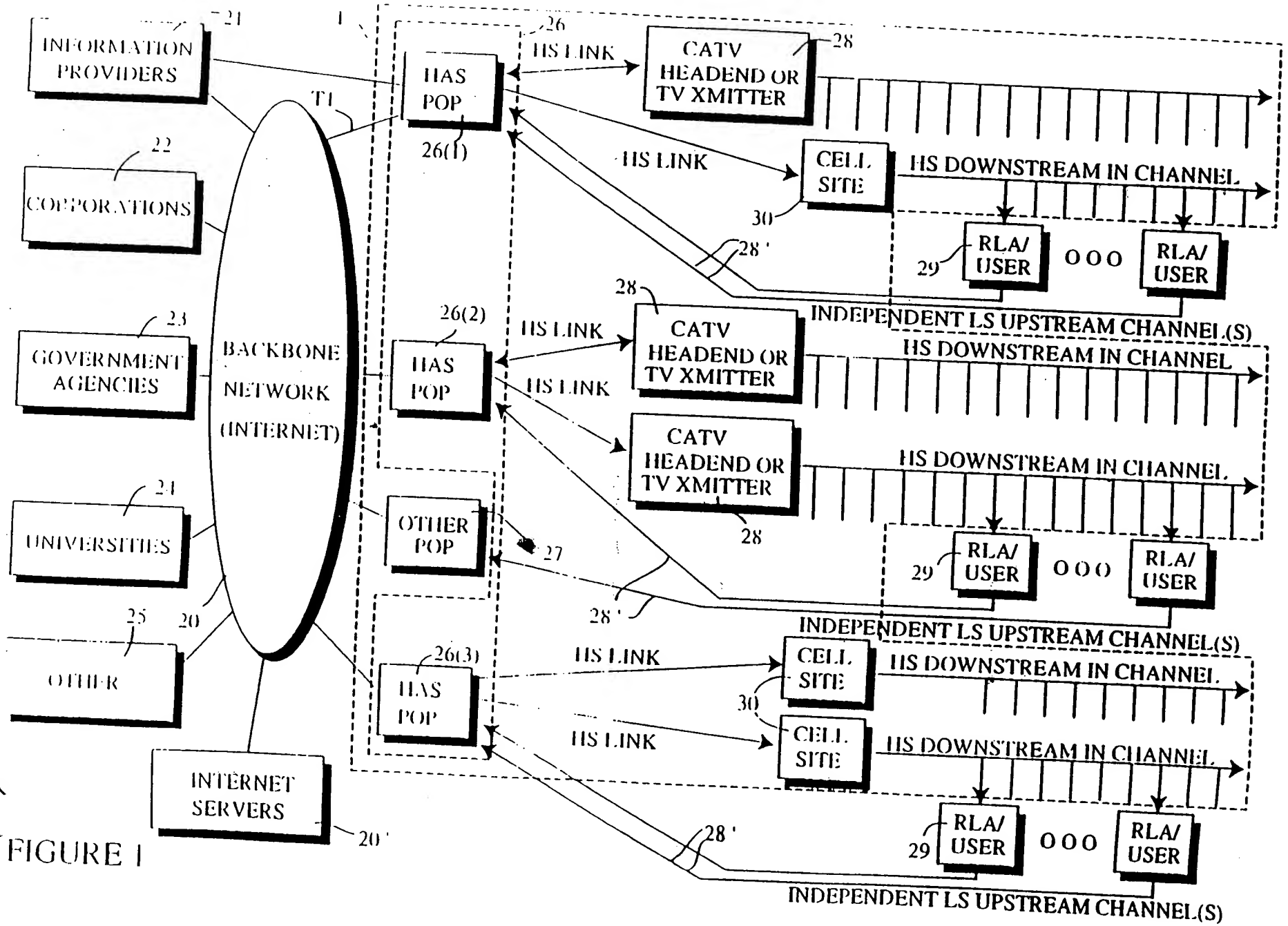
INFORMATION PROVIDERS
21
CORPORATIONS
22
GOVERNMENT AGENCIES
23
UNIVERSITIES
24
OTHER
25
INTERNET SERVERS
20'
BACKBONE NETWORK (INTERNET)
T1
20
1
HAS POP
26(1)
HAS POP
26(2)
HAS POP
26(3)
OTHER POP
27
26
HS LINK
HS LINK
HS LINK
HS LINK
HS LINK
CATV HEADEND OR TV XMITTER
28
CATV HEADEND OR TV XMITTER
28
CATV HEADEND OR TV XMITTER
28
CELL SITE
30
CELL SITE
30
HS DOWNSTREAM IN CHANNEL
HS DOWNSTREAM IN CHANNEL
HS DOWNSTREAM IN CHANNEL
HS DOWNSTREAM IN CHANNEL
28'
28'
28'
INDEPENDENT LS UPSTREAM CHANNEL(S)
INDEPENDENT LS UPSTREAM CHANNEL(S)
INDEPENDENT LS UPSTREAM CHANNEL(S)
RLA/ USER
29
RLA/ USER
RLA/ USER
RLA/ USER
RLA/ USER
OOO
OOO
OOO

FIGURE 1

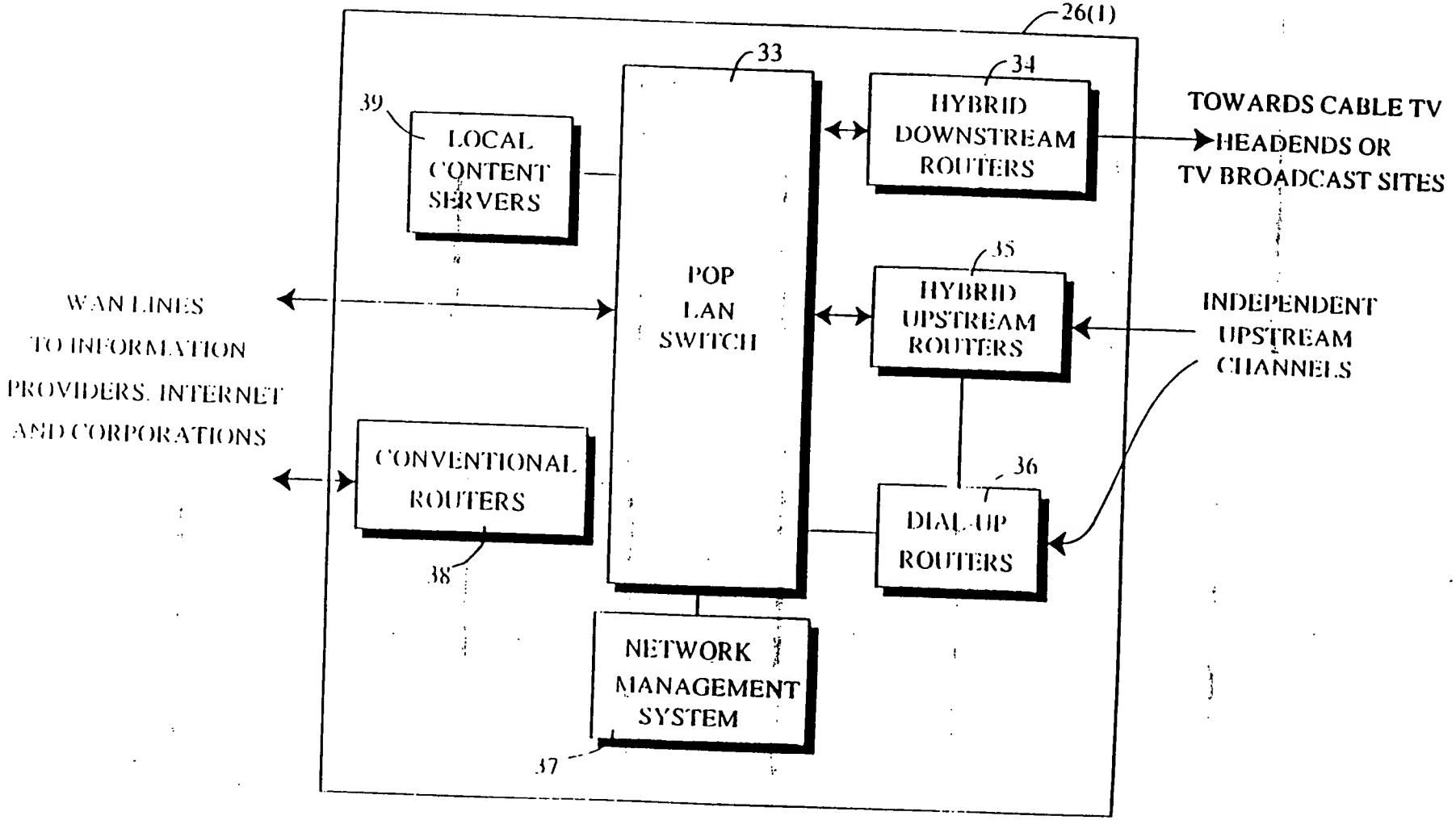
26(1)
33
34
39
LOCAL CONTENT SERVERS
HYBRID DOWNSTREAM ROUTERS
TOWARDS CABLE TV HEADENDS OR TV BROADCAST SITES
POP LAN SWITCH
35
HYBRID UPSTREAM ROUTERS
WAN LINES TO INFORMATION PROVIDERS, INTERNET AND CORPORATIONS
INDEPENDENT UPSTREAM CHANNELS
CONVENTIONAL ROUTERS
36
DIAL-UP ROUTERS
38
NETWORK MANAGEMENT SYSTEM
37

FIGURE 2a

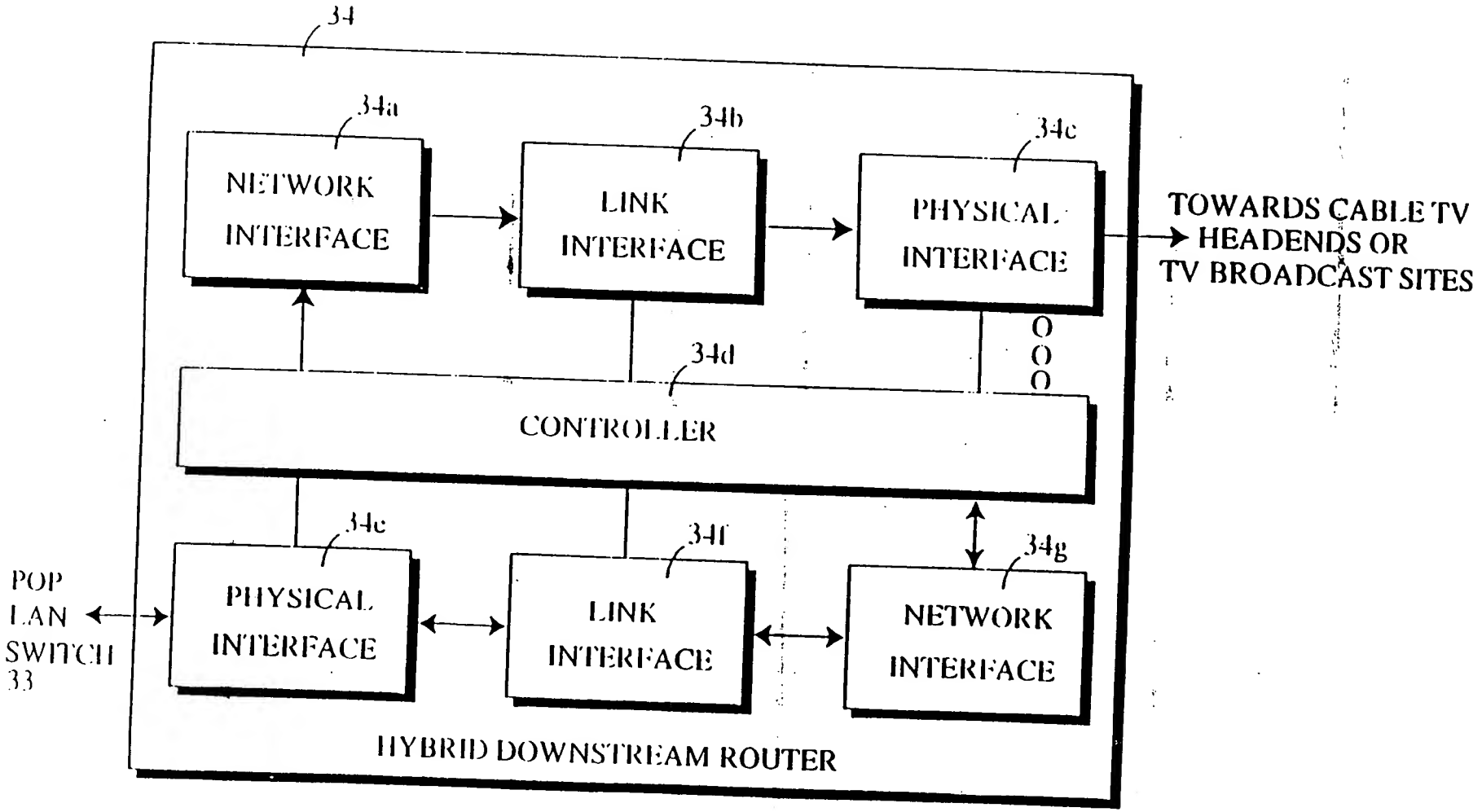
34
34a
NETWORK INTERFACE
34b
LINK INTERFACE
34c
PHYSICAL INTERFACE
TOWARDS CABLE TV HEADENDS OR TV BROADCAST SITES
34d
CONTROLLER
34e
PHYSICAL INTERFACE
34f
LINK INTERFACE
34g
NETWORK INTERFACE
POP LAN SWITCH 33
HYBRID DOWNSTREAM ROUTER

FIGURE 2b

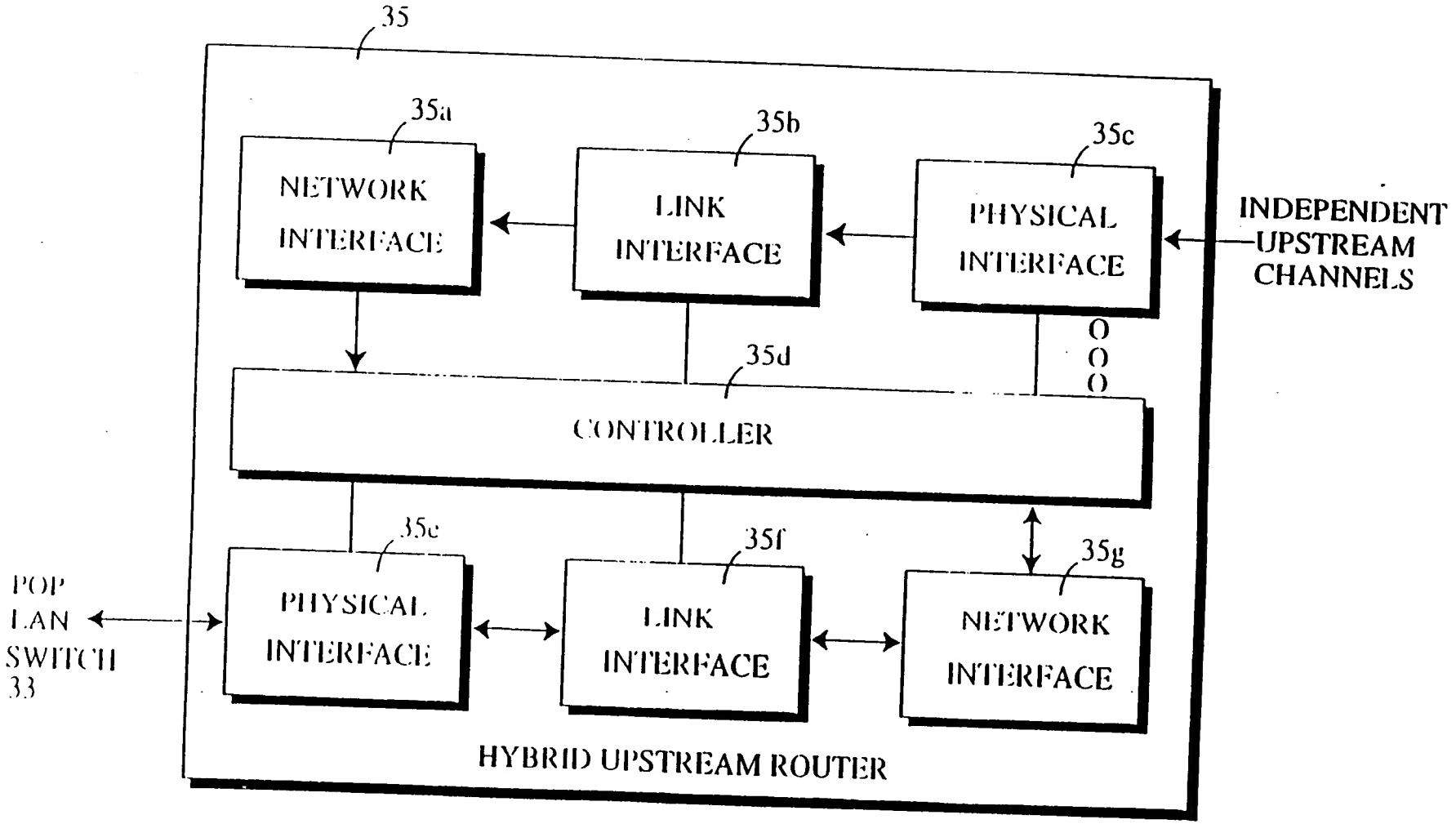
35
35a
NETWORK INTERFACE
35b
LINK INTERFACE
35c
PHYSICAL INTERFACE
INDEPENDENT UPSTREAM CHANNELS
O O O
35d
CONTROLLER
35e
PHYSICAL INTERFACE
35f
LINK INTERFACE
35g
NETWORK INTERFACE
POP LAN SWITCH 33
HYBRID UPSTREAM ROUTER

FIGURE 2c

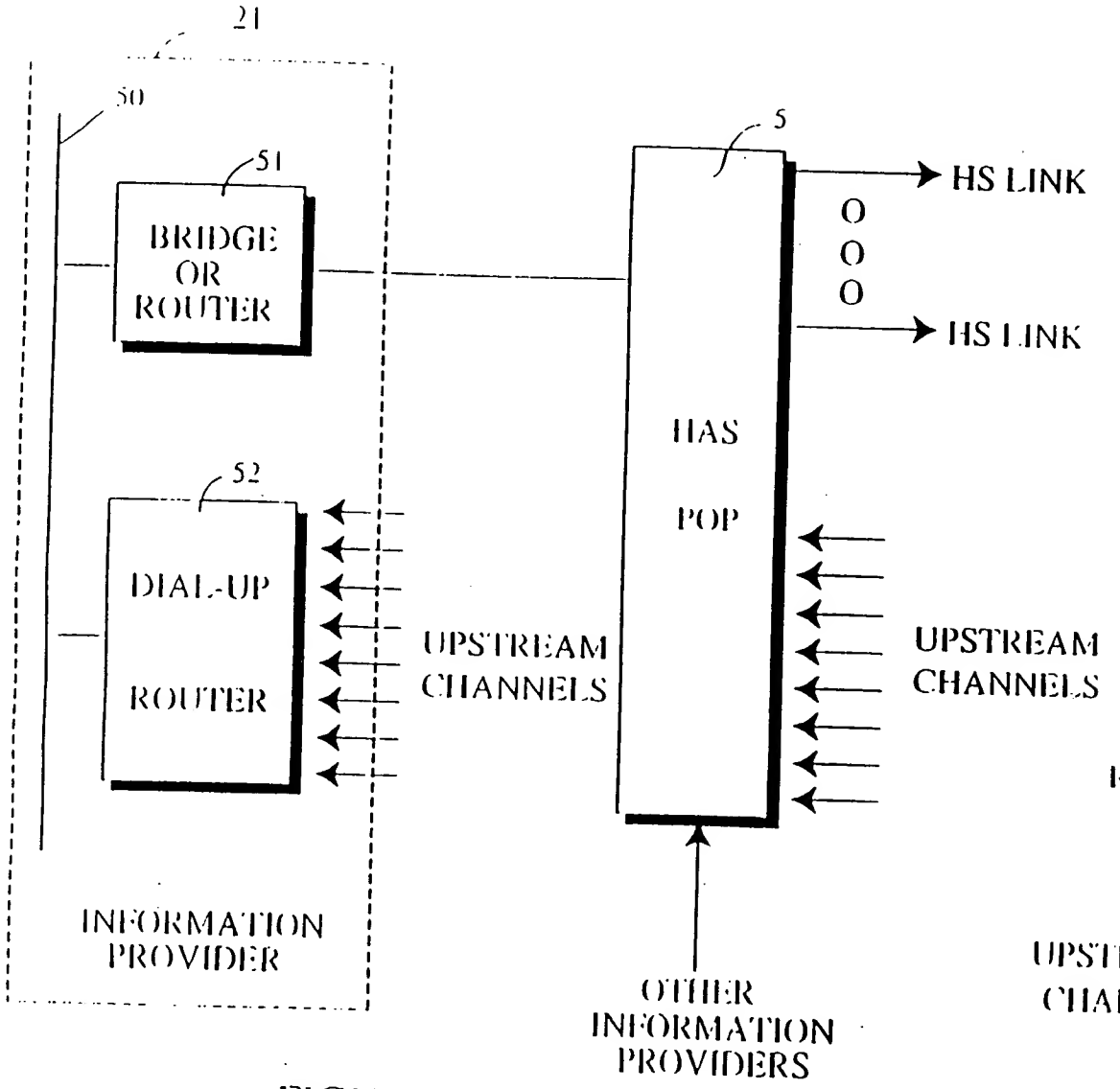

FIGURE 3a

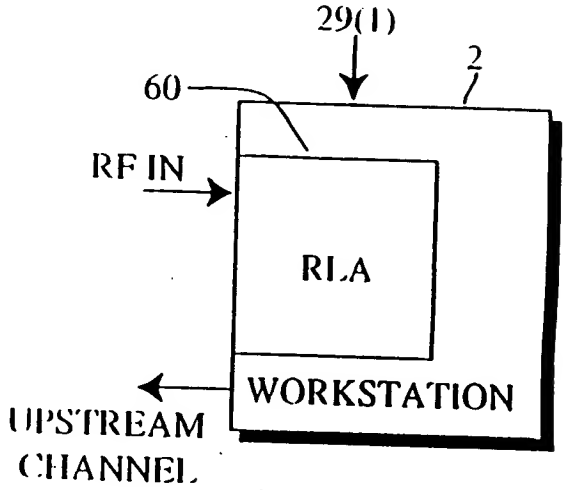

FIGURE 3b

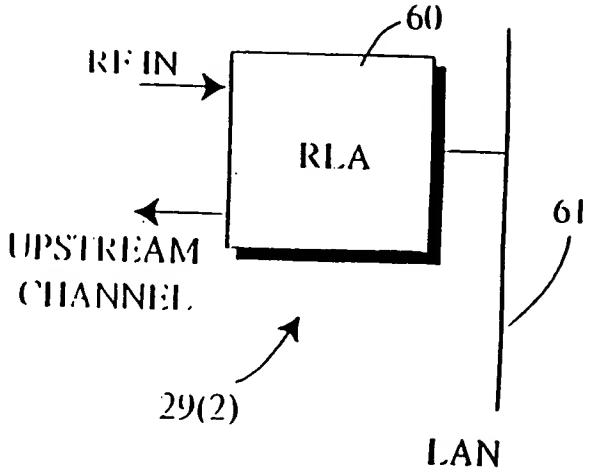

FIGURE 3c

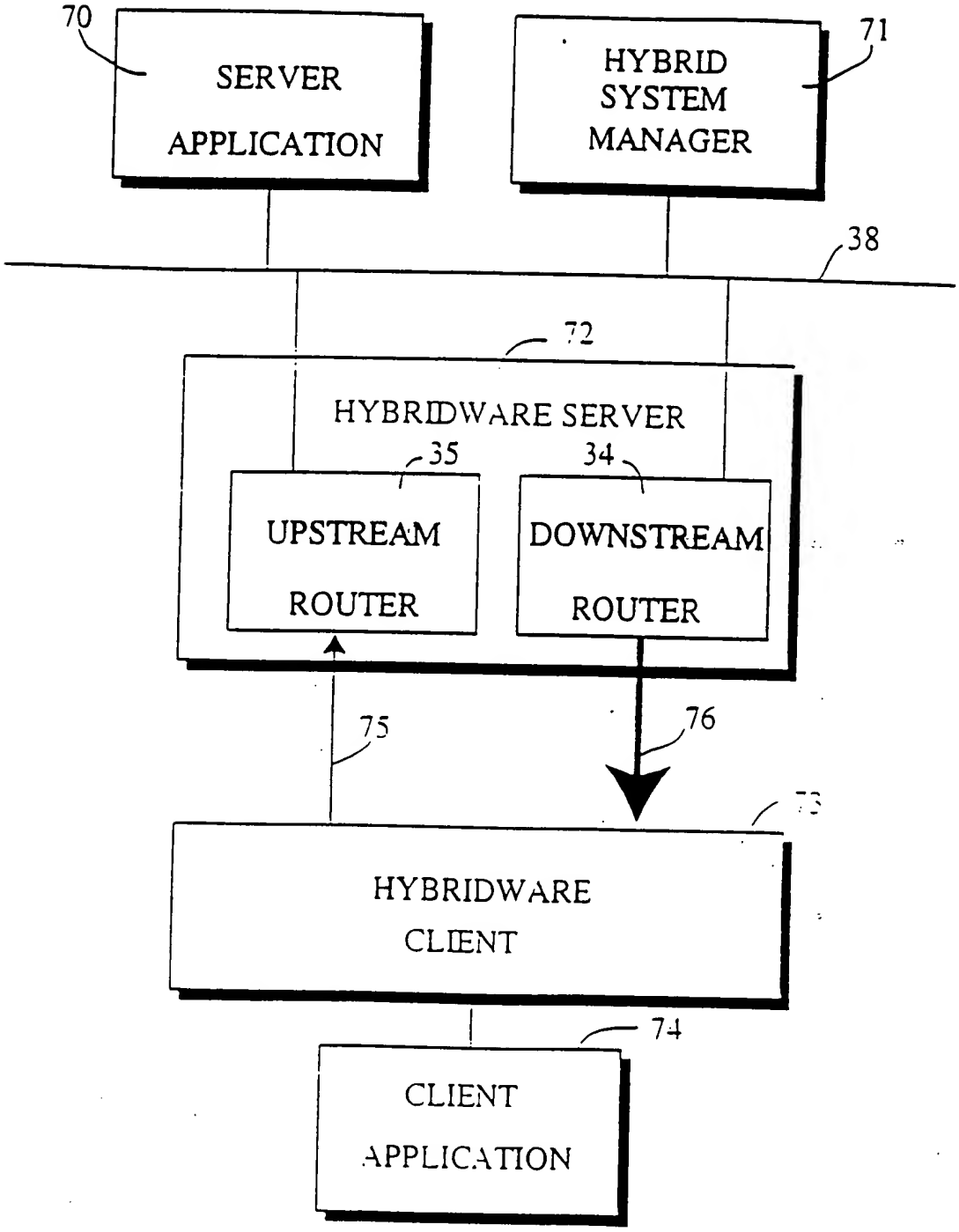
70
SERVER APPLICATION
71
HYBRID SYSTEM MANAGER
38
72
HYBRIDWARE SERVER
35
34
UPSTREAM ROUTER
DOWNSTREAM ROUTER
75
76
73
HYBRIDWARE CLIENT
74
CLIENT APPLICATION

FIGURE 4

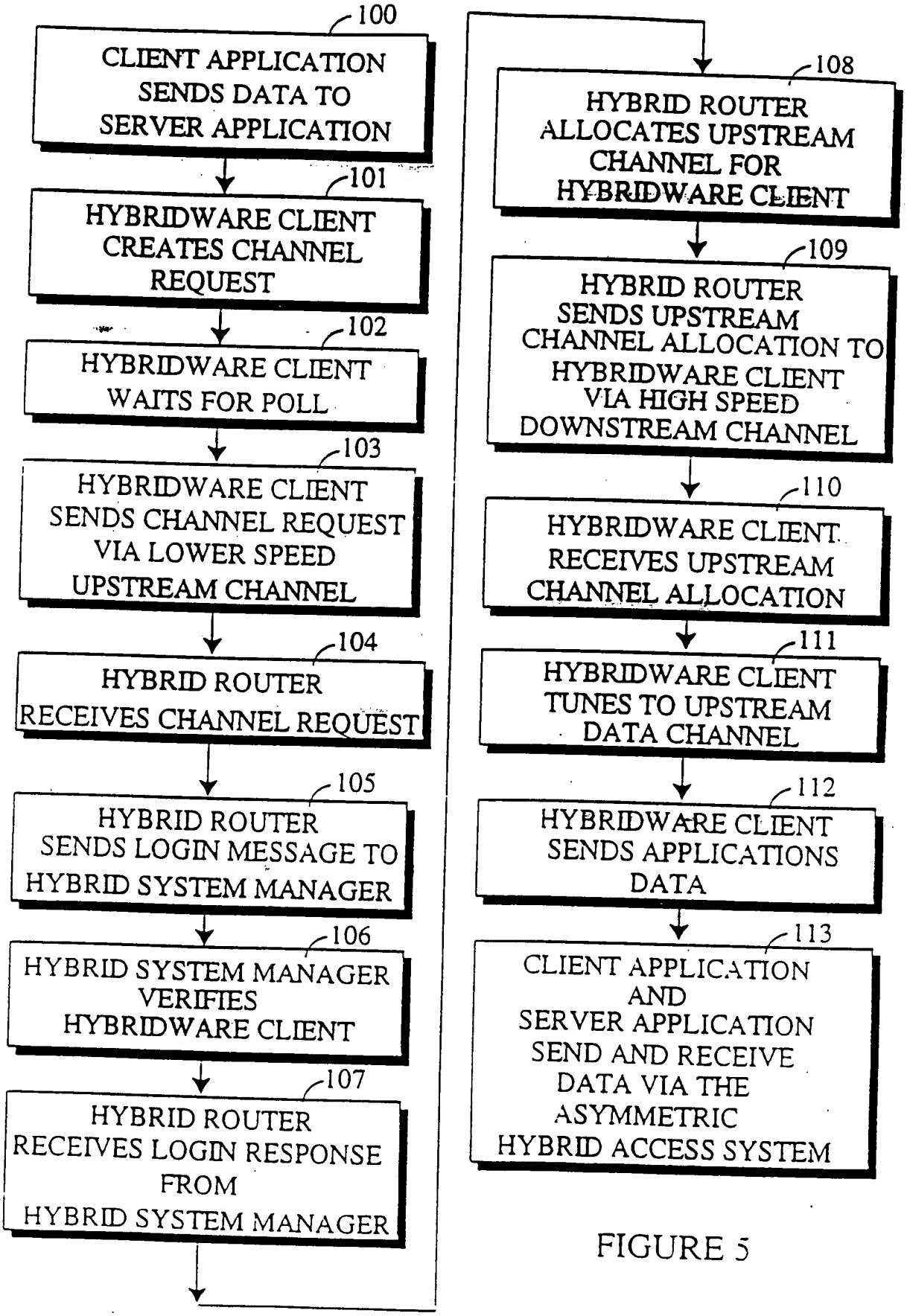
100
CLIENT APPLICATION SENDS DATA TO SERVER APPLICATION
101
HYBRIDWARE CLIENT CREATES CHANNEL REQUEST
102
HYBRIDWARE CLIENT WAITS FOR POLL
103
HYBRIDWARE CLIENT SENDS CHANNEL REQUEST VIA LOWER SPEED UPSTREAM CHANNEL
104
HYBRID ROUTER RECEIVES CHANNEL REQUEST
105
HYBRID ROUTER SENDS LOGIN MESSAGE TO HYBRID SYSTEM MANAGER
106
HYBRID SYSTEM MANAGER VERIFIES HYBRIDWARE CLIENT
107
HYBRID ROUTER RECEIVES LOGIN RESPONSE FROM HYBRID SYSTEM MANAGER
108
HYBRID ROUTER ALLOCATES UPSTREAM CHANNEL FOR HYBRIDWARE CLIENT
109
HYBRID ROUTER SENDS UPSTREAM CHANNEL ALLOCATION TO HYBRIDWARE CLIENT VIA HIGH SPEED DOWNSTREAM CHANNEL
110
HYBRIDWARE CLIENT RECEIVES UPSTREAM CHANNEL ALLOCATION
111
HYBRIDWARE CLIENT TUNES TO UPSTREAM DATA CHANNEL
112
HYBRIDWARE CLIENT SENDS APPLICATIONS DATA
113
CLIENT APPLICATION AND SERVER APPLICATION SEND AND RECEIVE DATA VIA THE ASYMMETRIC HYBRID ACCESS SYSTEM

FIGURE 5

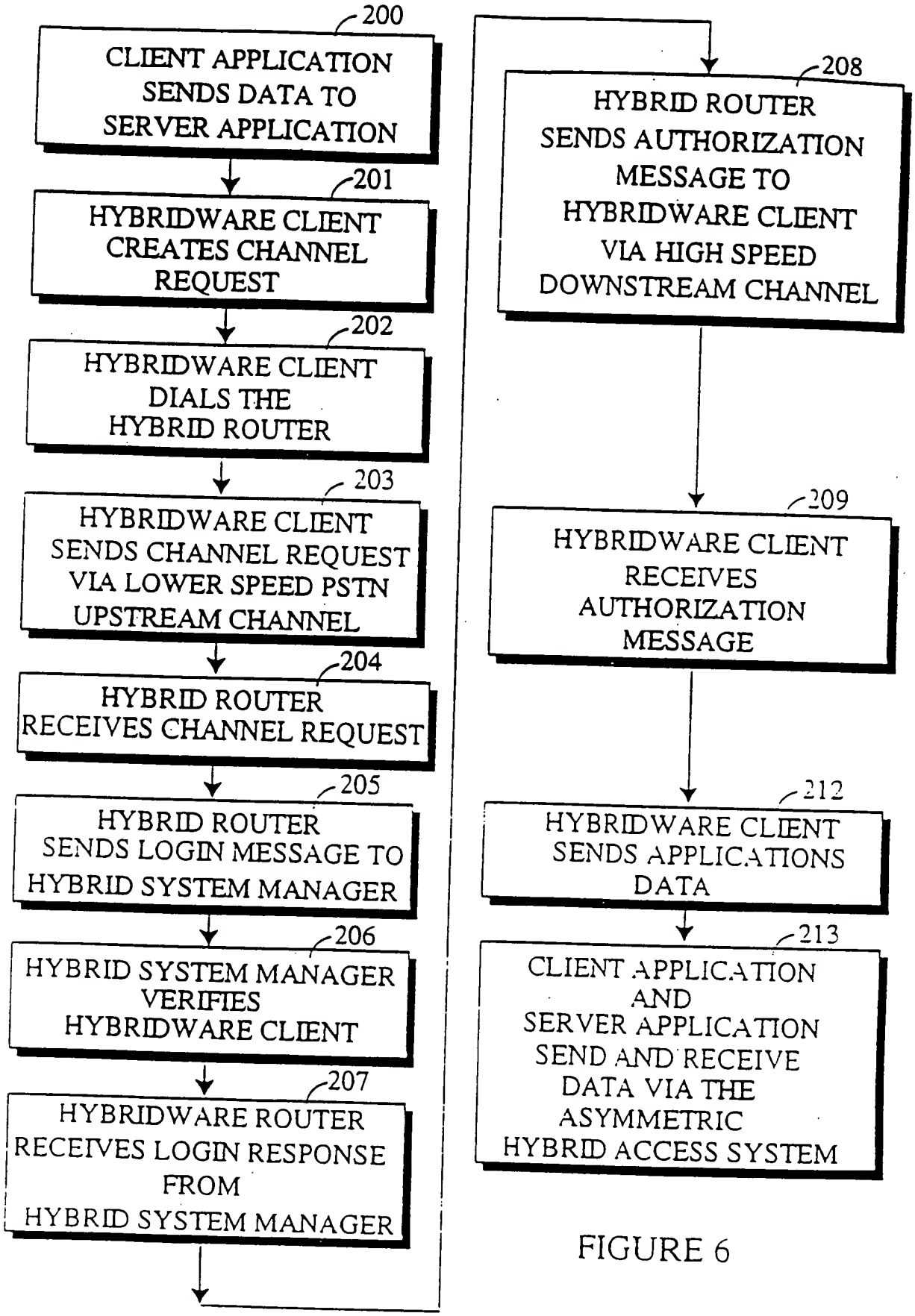
200
CLIENT APPLICATION SENDS DATA TO SERVER APPLICATION
201
HYBRIDWARE CLIENT CREATES CHANNEL REQUEST
202
HYBRIDWARE CLIENT DIALS THE HYBRID ROUTER
203
HYBRIDWARE CLIENT SENDS CHANNEL REQUEST VIA LOWER SPEED PSTN UPSTREAM CHANNEL
204
HYBRID ROUTER RECEIVES CHANNEL REQUEST
205
HYBRID ROUTER SENDS LOGIN MESSAGE TO HYBRID SYSTEM MANAGER
206
HYBRID SYSTEM MANAGER VERIFIES HYBRIDWARE CLIENT
207
HYBRIDWARE ROUTER RECEIVES LOGIN RESPONSE FROM HYBRID SYSTEM MANAGER
208
HYBRID ROUTER SENDS AUTHORIZATION MESSAGE TO HYBRIDWARE CLIENT VIA HIGH SPEED DOWNSTREAM CHANNEL
209
HYBRIDWARE CLIENT RECEIVES AUTHORIZATION MESSAGE
212
HYBRIDWARE CLIENT SENDS APPLICATIONS DATA
213
CLIENT APPLICATION AND SERVER APPLICATION SEND AND RECEIVE DATA VIA THE ASYMMETRIC HYBRID ACCESS SYSTEM

FIGURE 6

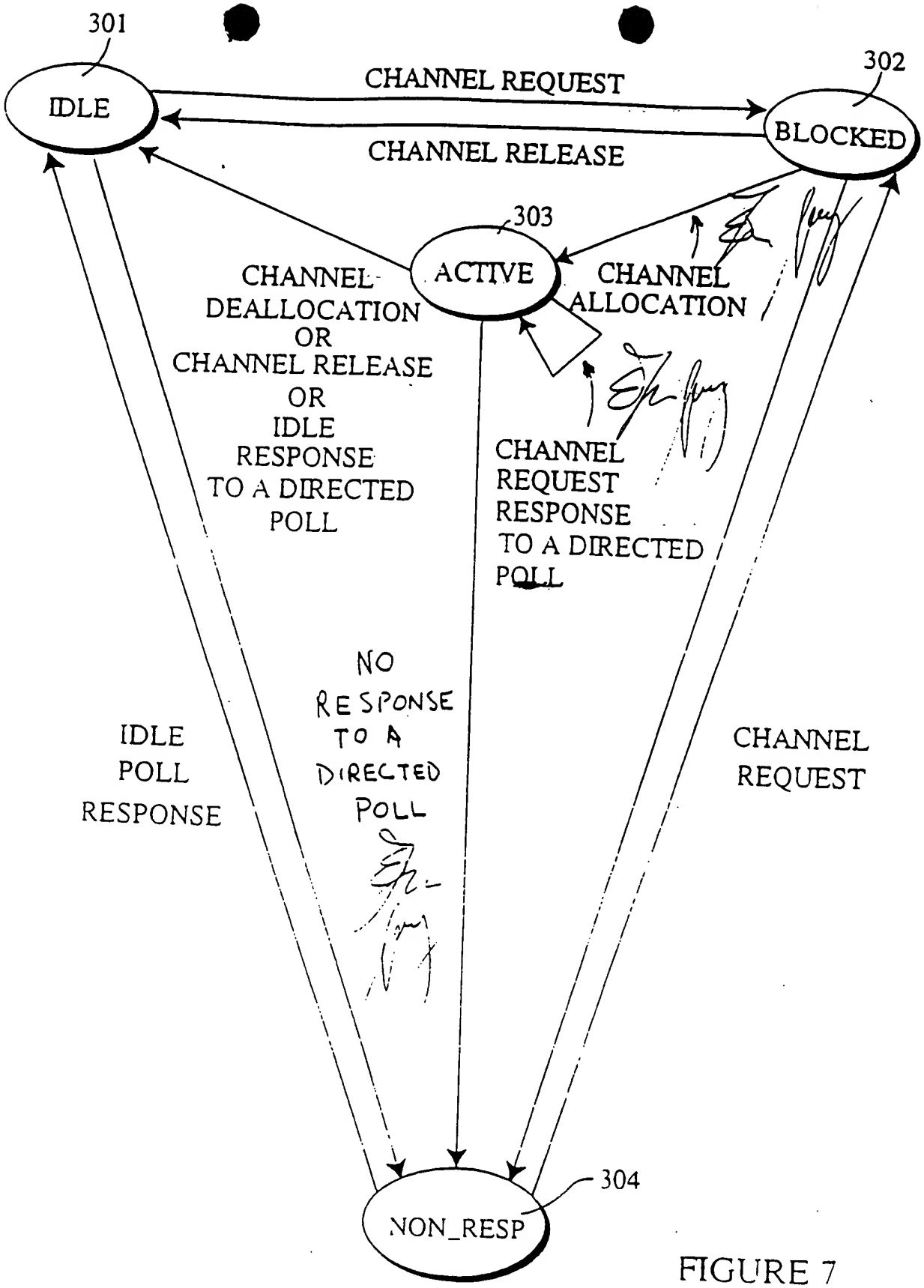
301
IDLE
CHANNEL REQUEST
CHANNEL RELEASE
302
BLOCKED
303
ACTIVE
CHANNEL DEALLOCATION OR CHANNEL RELEASE OR IDLE RESPONSE TO A DIRECTED POLL
CHANNEL ALLOCATION
CHANNEL REQUEST RESPONSE TO A DIRECTED POLL
NO RESPONSE TO A DIRECTED POLL
IDLE POLL RESPONSE
CHANNEL REQUEST
304
NON_RESP

FIGURE 7

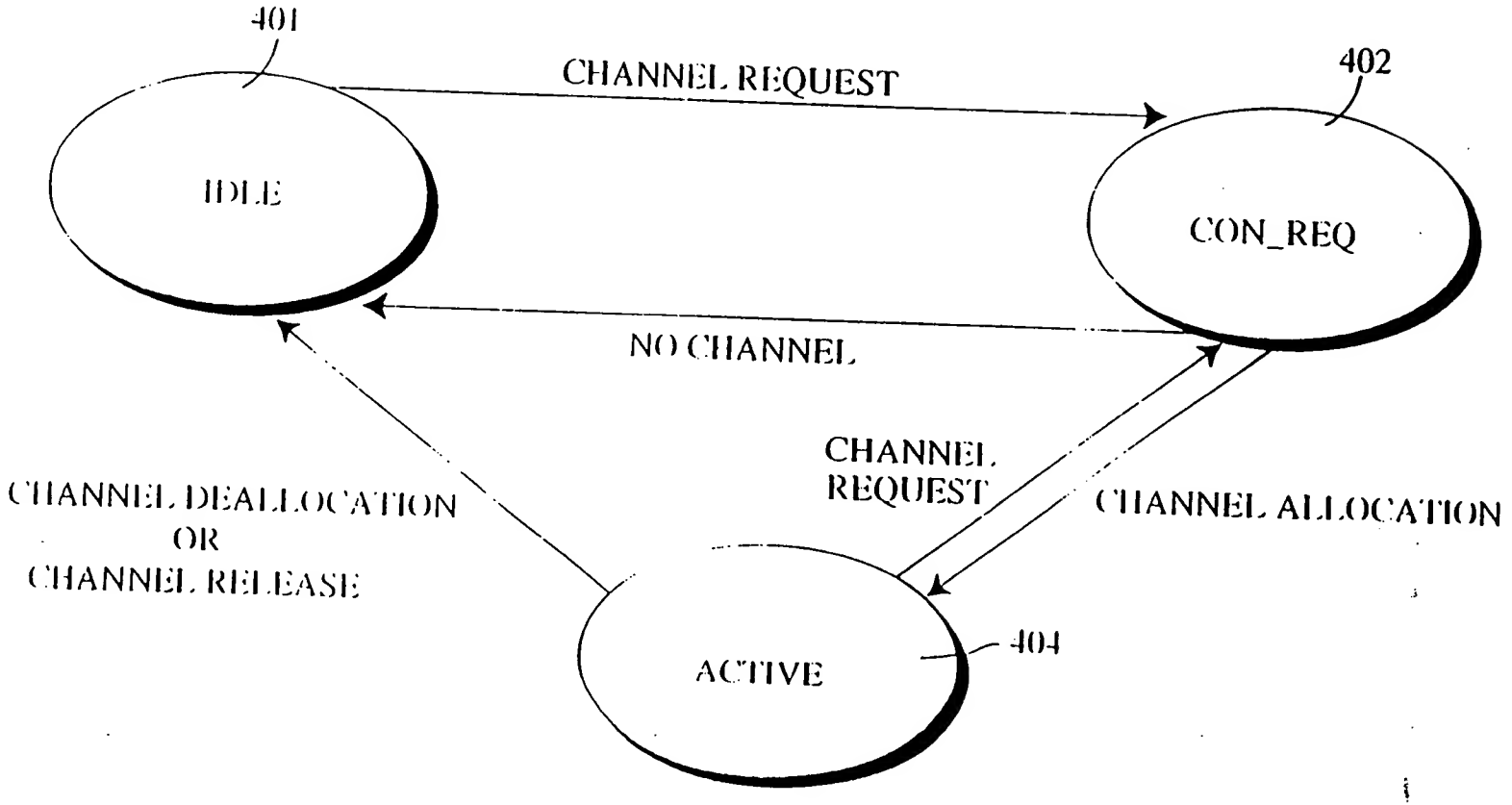
401
CHANNEL REQUEST
402
IDLE
CON_REQ
NO CHANNEL
CHANNEL
REQUEST
CHANNEL DEALLOCATION
OR
CHANNEL RELEASE
CHANNEL ALLOCATION
ACTIVE
404

FIGURE 8

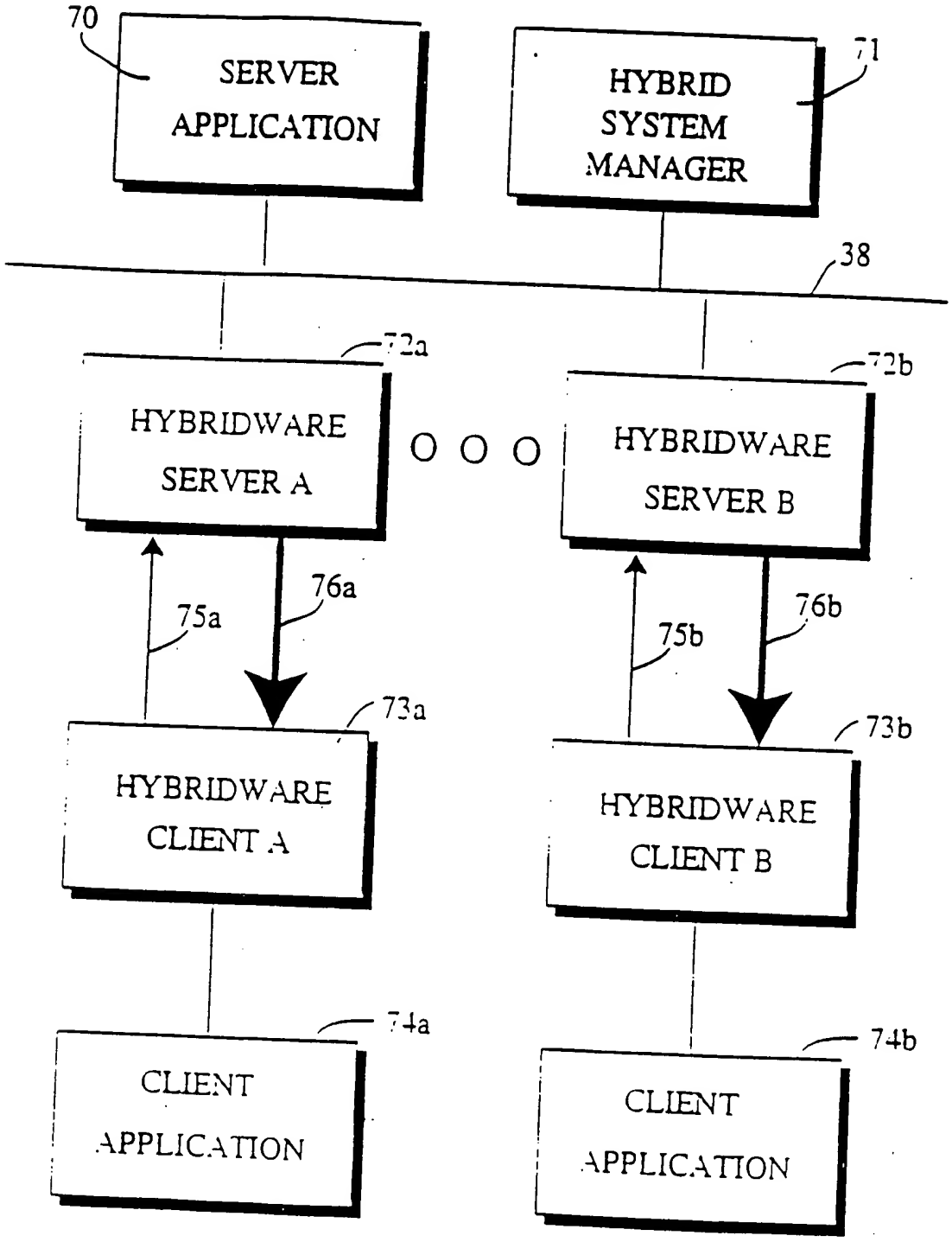
70
SERVER APPLICATION
HYBRID SYSTEM MANAGER
71
38
72a
72b
HYBRIDWARE SERVER A
O O O
HYBRIDWARE SERVER B
75a
76a
75b
76b
73a
73b
HYBRIDWARE CLIENT A
HYBRIDWARE CLIENT B
74a
74b
CLIENT APPLICATION
CLIENT APPLICATION

FIGURE 9

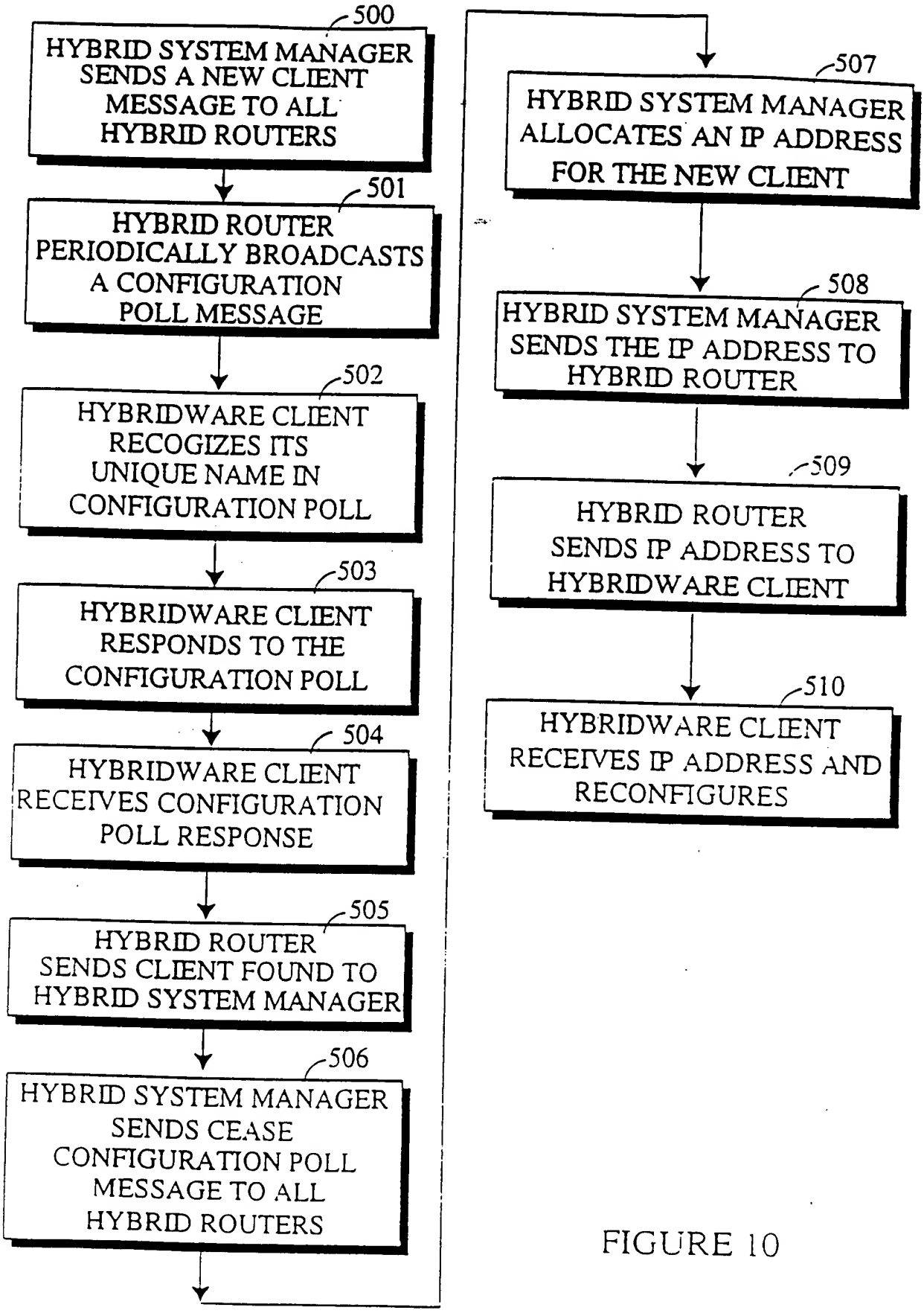
500
HYBRID SYSTEM MANAGER SENDS A NEW CLIENT MESSAGE TO ALL HYBRID ROUTERS
501
HYBRID ROUTER PERIODICALLY BROADCASTS A CONFIGURATION POLL MESSAGE
502
HYBRIDWARE CLIENT RECOGIZES ITS UNIQUE NAME IN CONFIGURATION POLL
503
HYBRIDWARE CLIENT RESPONDS TO THE CONFIGURATION POLL
504
HYBRIDWARE CLIENT RECEIVES CONFIGURATION POLL RESPONSE
505
HYBRID ROUTER SENDS CLIENT FOUND TO HYBRID SYSTEM MANAGER
506
HYBRID SYSTEM MANAGER SENDS CEASE CONFIGURATION POLL MESSAGE TO ALL HYBRID ROUTERS
507
HYBRID SYSTEM MANAGER ALLOCATES AN IP ADDRESS FOR THE NEW CLIENT
508
HYBRID SYSTEM MANAGER SENDS THE IP ADDRESS TO HYBRID ROUTER
509
HYBRID ROUTER SENDS IP ADDRESS TO HYBRIDWARE CLIENT
510
HYBRIDWARE CLIENT RECEIVES IP ADDRESS AND RECONFIGURES

FIGURE 10

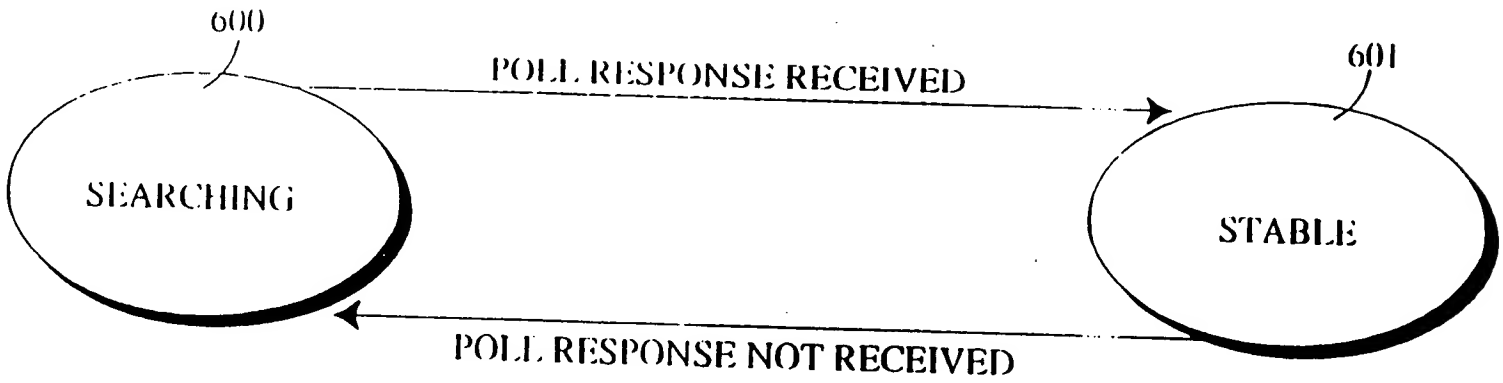
600
SEARCHING
POLL RESPONSE RECEIVED
601
STABLE
POLL RESPONSE NOT RECEIVED

FIGURE 11

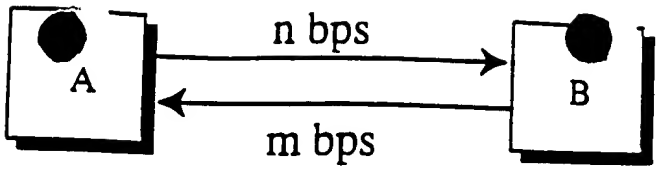

FIGURE 12a
PRIOR ART

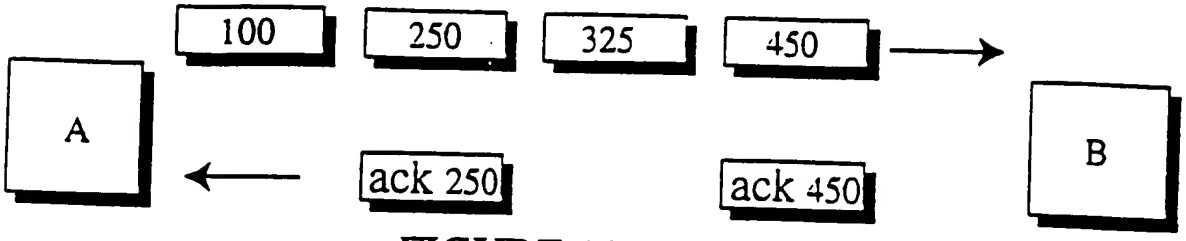

FIGURE 12b
PRIOR ART

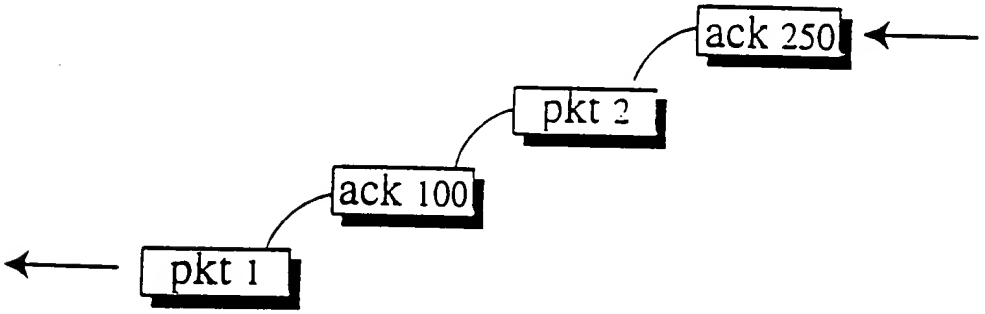

FIGURE 12c

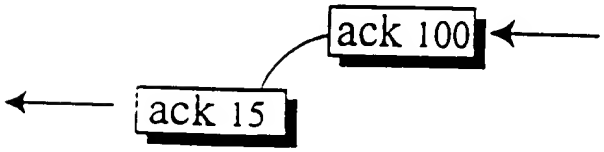

FIGURE 12d

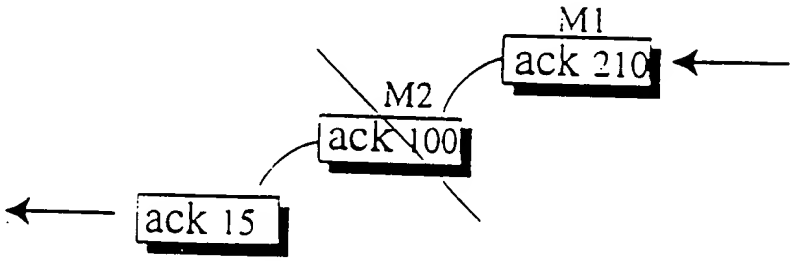

FIGURE 12e

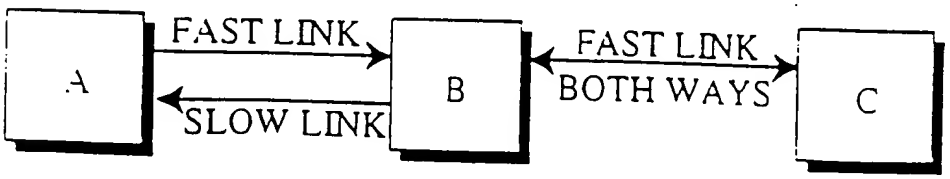

FIGURE 12f

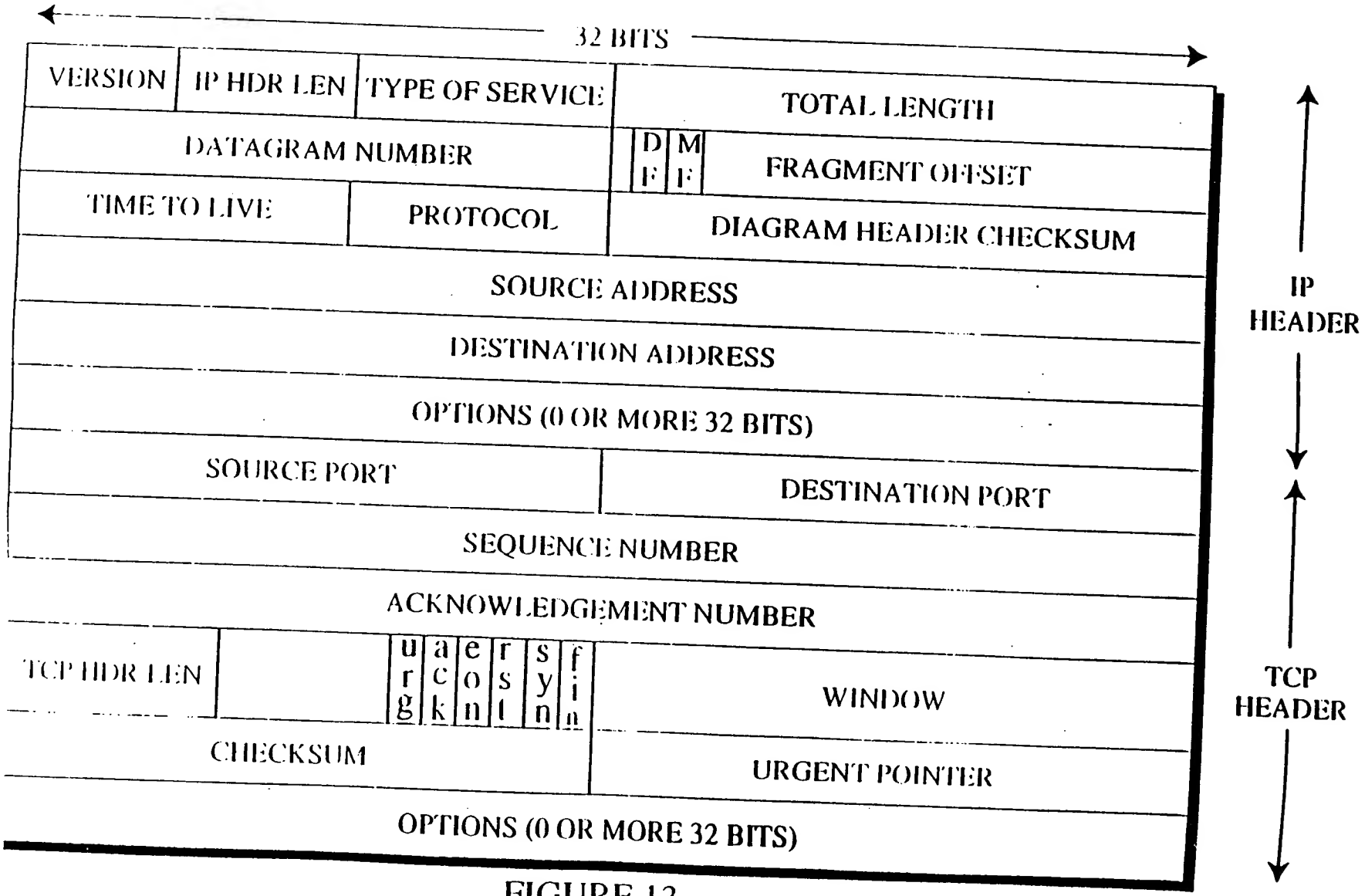
32 BITS
VERSION
IP HDR LEN
TYPE OF SERVICE
TOTAL LENGTH
DATAGRAM NUMBER
DF
MF
FRAGMENT OFFSET
TIME TO LIVE
PROTOCOL
DIAGRAM HEADER CHECKSUM
SOURCE ADDRESS
DESTINATION ADDRESS
OPTIONS (0 OR MORE 32 BITS)
SOURCE PORT
DESTINATION PORT
SEQUENCE NUMBER
ACKNOWLEDGEMENT NUMBER
TCP HDR LEN
urg
ack
eon
rst
syn
fin
WINDOW
CHECKSUM
URGENT POINTER
OPTIONS (0 OR MORE 32 BITS)
IP HEADER
TCP HEADER

FIGURE 13

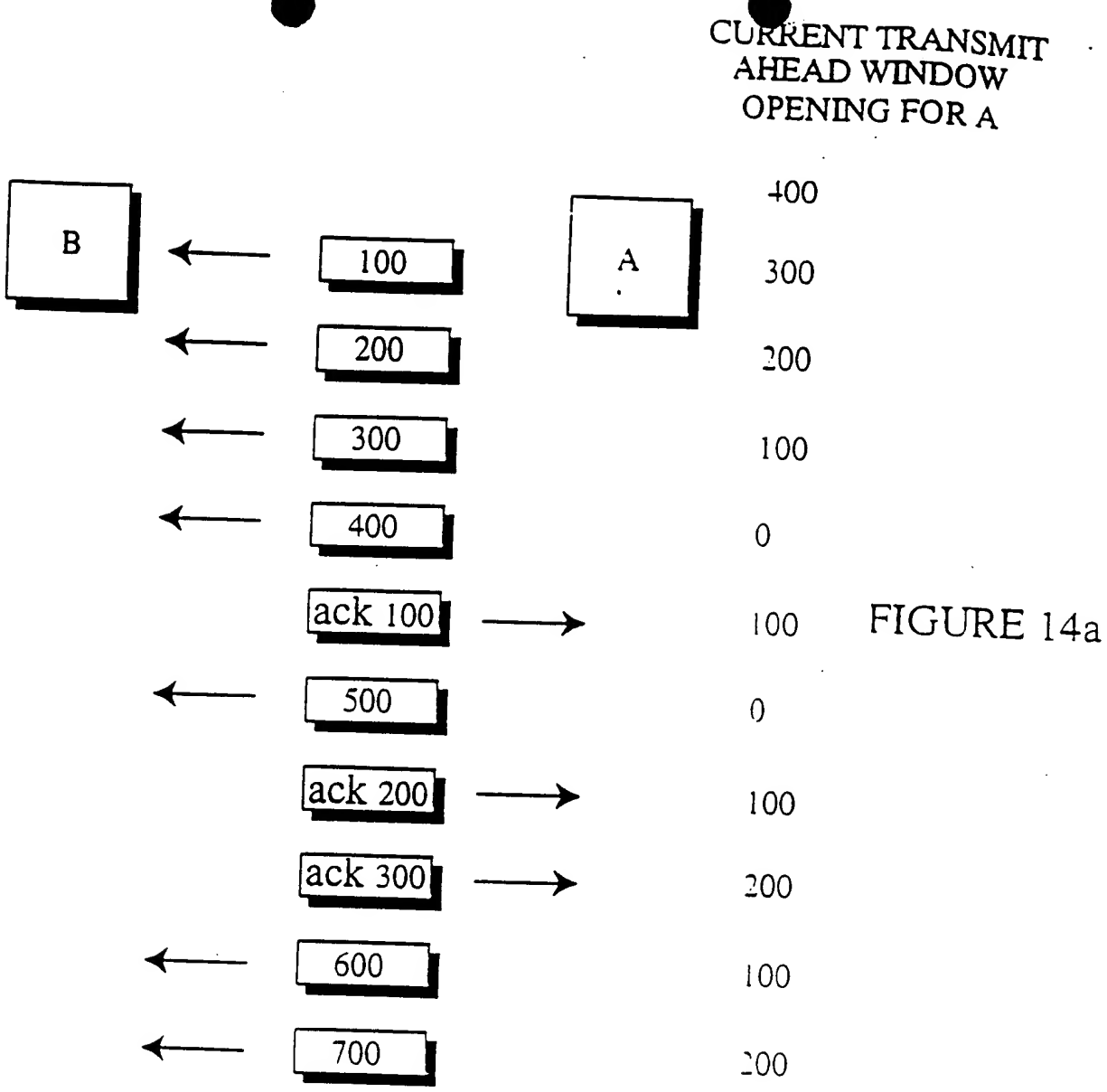

FIGURE 14a

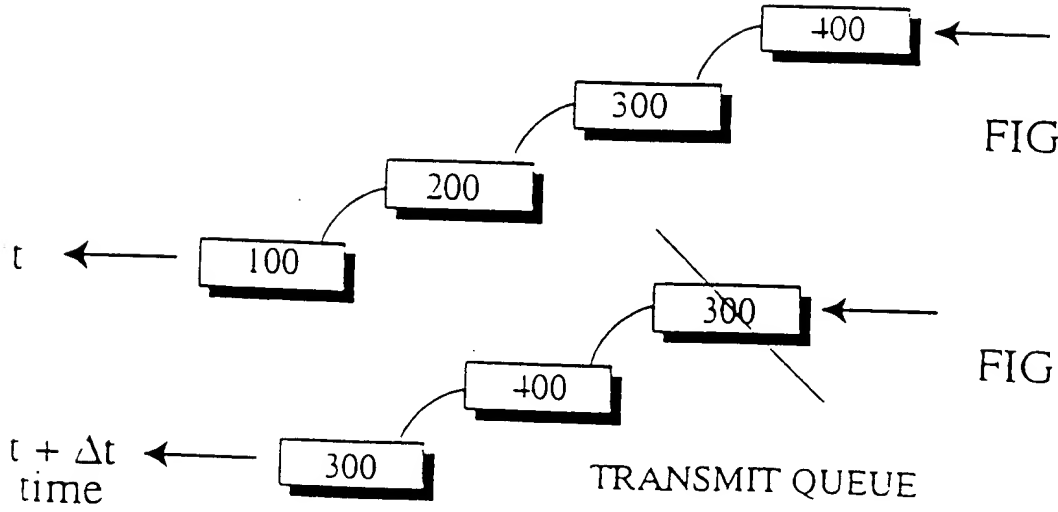

FIGURE 14b

FIGURE 14c

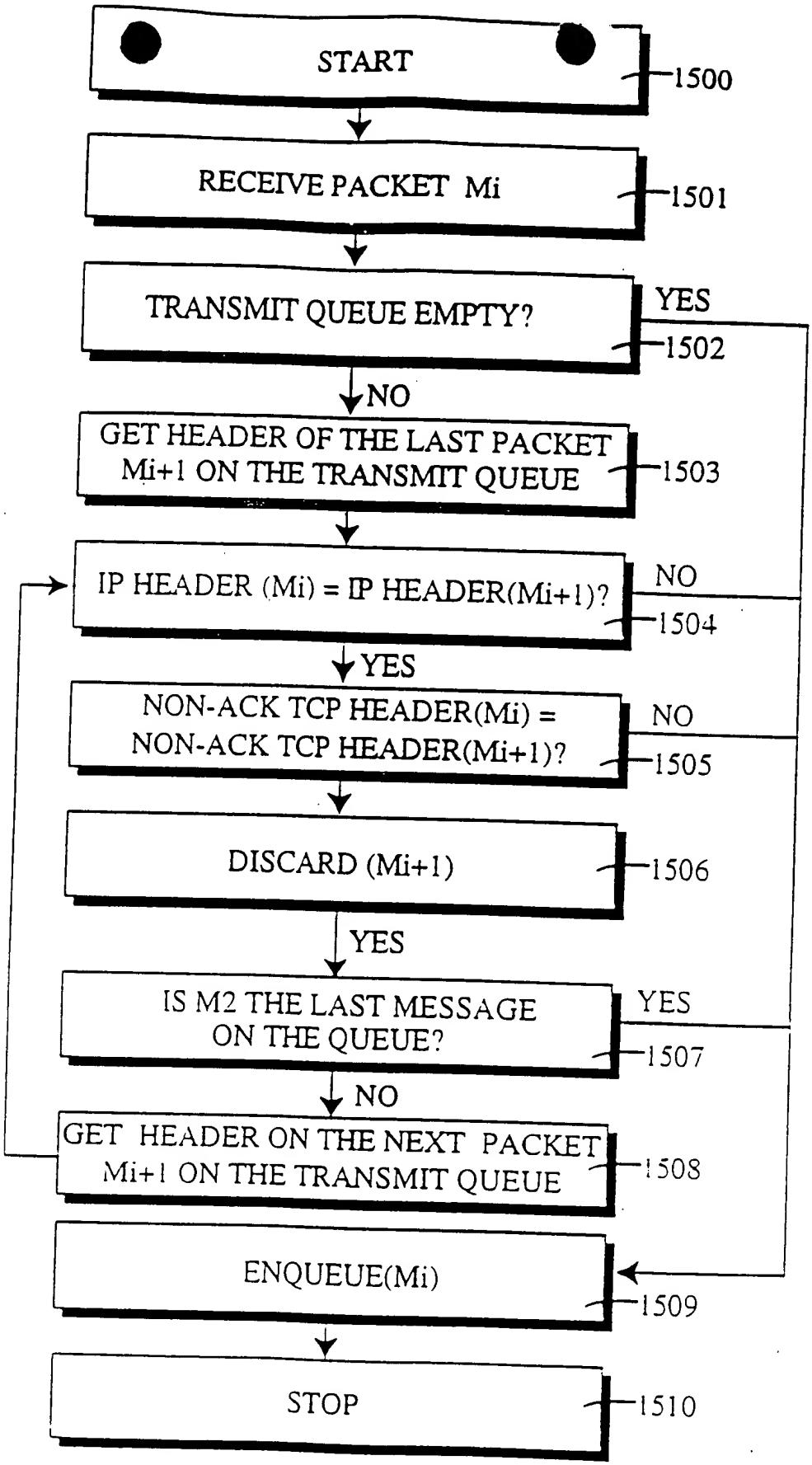
START
1500
RECEIVE PACKET Mi
1501
TRANSMIT QUEUE EMPTY?
YES
1502
NO
GET HEADER OF THE LAST PACKET Mi+1 ON THE TRANSMIT QUEUE
1503
IP HEADER (Mi) = IP HEADER(Mi+1)?
NO
1504
YES
NON-ACK TCP HEADER(Mi) = NON-ACK TCP HEADER(Mi+1)?
NO
1505
DISCARD (Mi+1)
1506
YES
IS M2 THE LAST MESSAGE ON THE QUEUE?
YES
1507
NO
GET HEADER ON THE NEXT PACKET Mi+1 ON THE TRANSMIT QUEUE
1508
ENQUEUE(Mi)
1509
STOP
1510

FIGURE 15

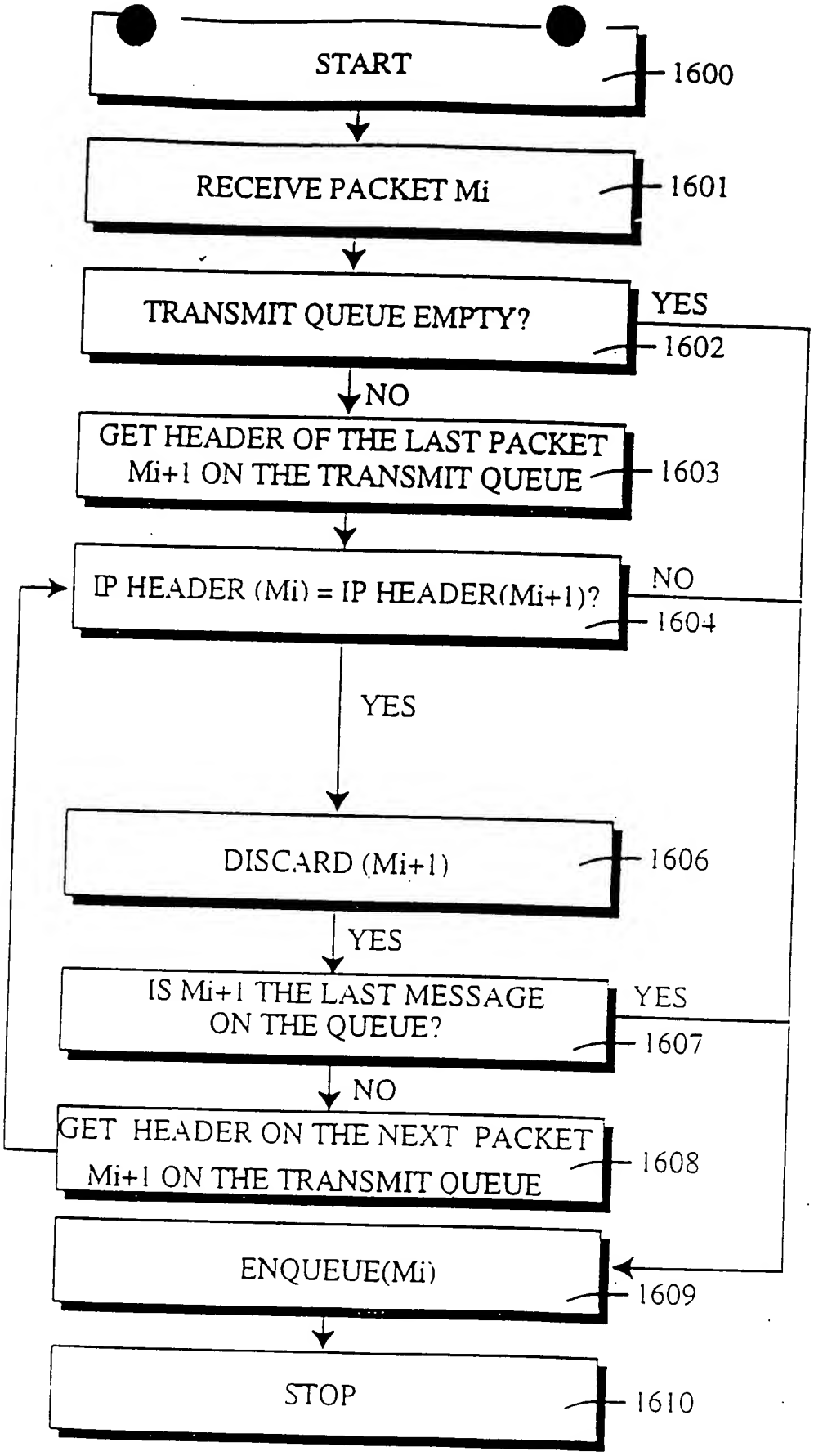
START
1600
RECEIVE PACKET Mi
1601
TRANSMIT QUEUE EMPTY?
YES
1602
NO
GET HEADER OF THE LAST PACKET Mi+1 ON THE TRANSMIT QUEUE
1603
IP HEADER (Mi) = IP HEADER(Mi+1)?
NO
1604
YES
DISCARD (Mi+1)
1606
YES
IS Mi+1 THE LAST MESSAGE ON THE QUEUE?
YES
1607
NO
GET HEADER ON THE NEXT PACKET Mi+1 ON THE TRANSMIT QUEUE
1608
ENQUEUE(Mi)
1609
STOP
1610

FIGURE 16

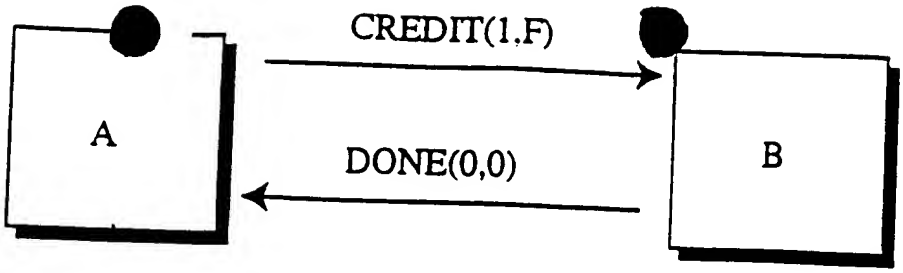

FIGURE 17

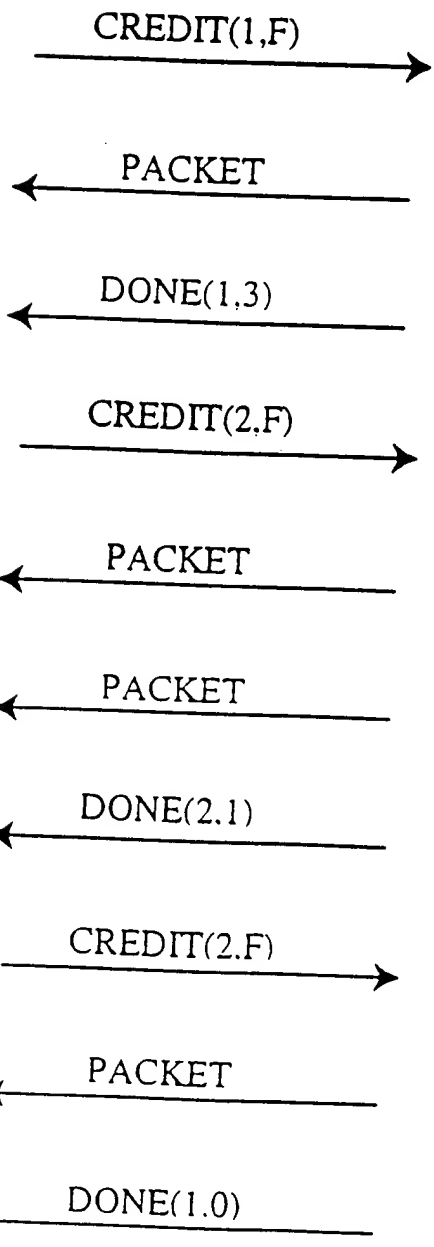

FIGURE 18

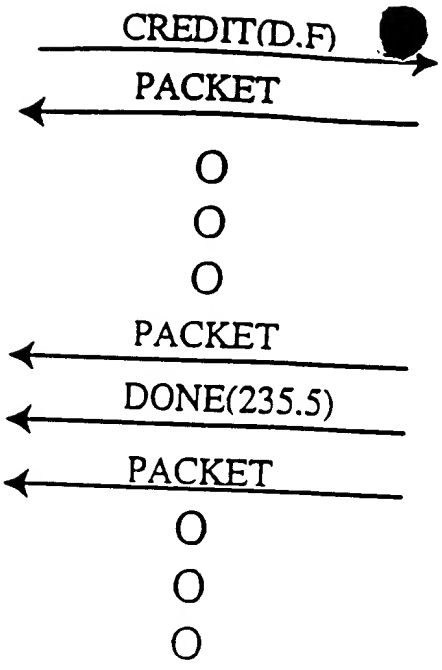

FIGURE 19

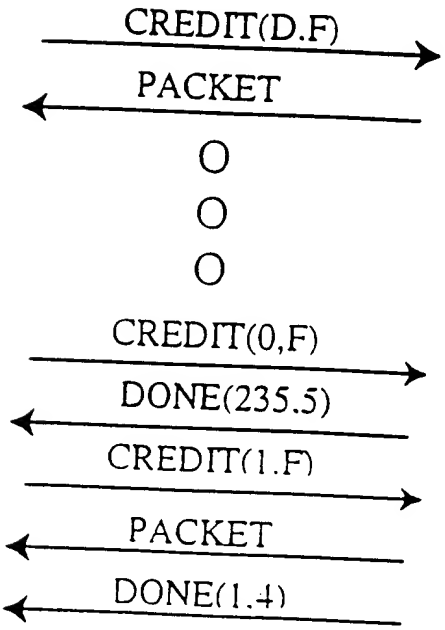

FIGURE 20